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Gold beaters skin in water is slightly electro-negative. Salts with univalent cations may cause the membrane material to become positively charged. The magnitude of the charge on the capillary walls increases with increase in valency of the cation. This explains the abnormally great osmose with $AlCl_3$ solution.

It is noted that the direction and the extent of osmose in the above experiments conform to predictions which follow from the application of the postulates given above. In those cases in which the direction of flow is not that actually indicated by the sign of the charge of the system, it will be noted that the osmose is abnormal and that the tendency is operative in the direction predicted.

The experiments with various types of membranes have been extended considerably beyond those cited. Parchment paper, gold beaters skin, collodion, and gelatine membranes have been studied. The generalizations outlined above have been found to apply very satisfactorily in the case of each of these types of membranes. The results will be published in the near future.

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[1] Bartell, F. E. and Hocker, C. D., *J. Amer. Chem. Soc.*, **38,** 1916 (1036).

[2] Robinson, C. S., *J. Phys. Chem.*, **22,** 1918 (99); **22,** 1918 (153).

[3] Unpublished data.

[4] Girard, P., *Rev. Gen. Sci.*, **20,** 1909 (694); Lillie, R. S., *Amer. J. Physiol.*, **28,** 1911 (194).

[5] Loeb, J., *J. Gen. Physiol.*, **2,** 1919 (87).

A PHOTOGRAPHIC METHOD OF FINDING THE INSTANTANEOUS VELOCITY OF SOUND WAVES AT POINTS NEAR THE SOURCE

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Communicated by R. A. Millikan, April 10, 1920

Sparks from the condensers L, L (Leyden jars, charged by an electric influence machine not shown in the figure) pass across the gaps G, G, the sound gap S, and the illuminating gap I. The light from the spark at I casts a shadow (caused by refraction) of the sound wave produced by the spark at S upon the photographic dry plate P, provided the spark at I occurs at the proper time. The gaps I and S are in series, the spark at S occurring first, the spark at I being retarded the proper time interval by means of an adjustable condenser K.

D is a steel disk 76 cm. in diameter mounted to rotate at high speed just in front of and near the lower edge of the dry plate P. The rim of the disk was ground to a chisel edge and very small teeth were cut in it at intervals of a cm. or so. The intervals and teeth were made irregular to insure the identification of their shadows on the photographic plate. The rotational speed of the disk was measured by means of a calibrated Van Sicklen-Elgin tachometer. A light-tight box encloses the spark gaps I and S, the dry plate P and the disk D.

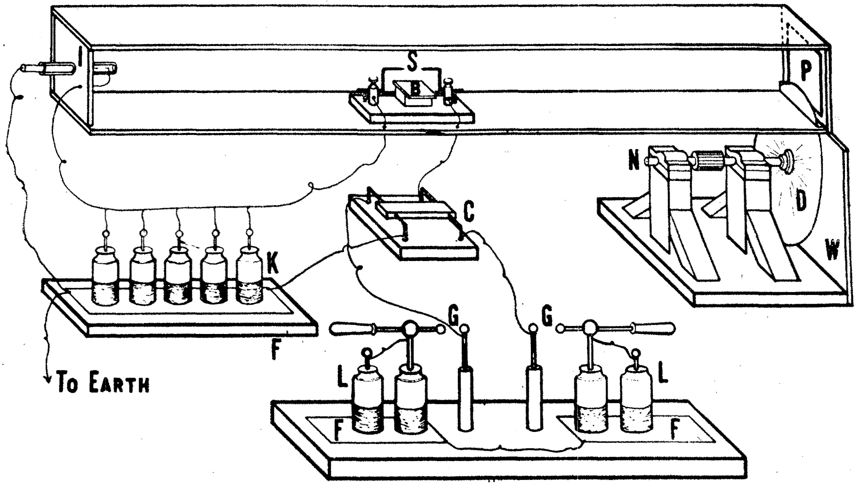

FIG. 1

When a spark occurs at S a cylindrical sound wave is generated and a shadow of the saw teeth is thrown on the photographic plate. Assuming that the time interval between S and I has been adjusted properly the spark at I casts on the dry plate a shadow of the sound wave and the teeth

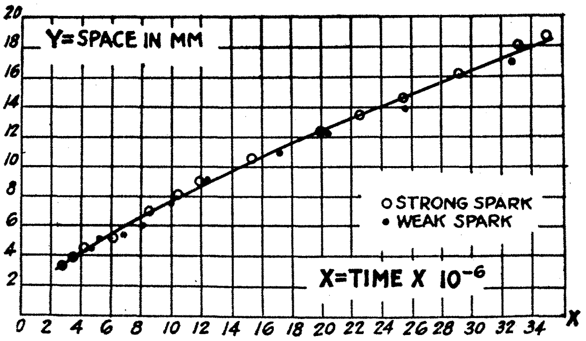

FIG. 2

of the disk, the latter having moved into a new position during the interval between the sparks. The true radius of the sound wave is calculated from the geometry of the figure and the radius as measured on the photographic plate. The time interval is calculated from the measured distance through which any given tooth has turned, together with the speed of rotation and the distances from the plate to I, S, and the disk D. Plotting wave radii as ordinates and the corresponding time intervals as abscissas, the tangent to the curve at any point gives the instantaneous velocity of sound at that distance from the source. The accompanying curve shows that the velocity varies from about 660 meters per sec. at a distance of 3.2 mm. from the sound source to 380 meters per second at a distance of 1.8 cm. Results have been obtained since the above curve was plotted for points much closer to the source and for distances up to a half meter.

The writer designates as "weak sparks" those produced when each condenser, L, consists of two Leyden jars; as "strong sparks," seven jars. The curve appears to show but little difference in the velocity of the resulting sound waves. However, considering the shortness of the sound pulses produced by such electric sparks, all are really intense waves at points near the source.

This investigation, made under a grant from the American Association for the Advancement of Science, will be published in full in the *Physical Review*.

CONFORMAL MAPPING OF A FAMILY OF REAL CONICS ON ANOTHER

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Communicated by E. H. Moore, April 27, 1920

Note IV On Conformal Mapping Under Aid of Grant No. 207 From the Bache Fund

Let $z = x + yi$ and $w = u + vi$ be two complex variables, and let the analytic function $w = w(z)$ define a conformal map of the z-plane upon the w-plane. It is the purpose of the present note to determine all functions $w(z)$ such that there exists a family (containing at least one real parameter) of real conics in the z-plane which is mapped upon a family (obviously with an equal number of parameters) of real conics in the w-plane. The particular case when the conics in the w-plane are straight lines parallel to the real axis has been investigated by Von der Mühll[1] and Meyer.[2]

It is convenient to use the isometric coördinate $z = x + yi$ and $\bar{z} = x - yi$, and we begin by establishing the following general results:

When $\bar{z} = f(z, t)$, where f is analytic in both its arguments and t is a real parameter, represents a family of real curves in the z-plane, and similarly $\bar{w} = F(w, t)$ is a family of real curves in the w-plane, the necessary and sufficient condition that $w = w(z)$ shall map these two families upon each other is that the relation